

A New Species of Cat Snake (Serpentes: Colubridae) Morphologically Similar to *Boiga cynodon* from the Nusa Tenggara Islands, Indonesia

Gilang Ramadhan¹, Djoko T. Iskandar^{1*} and Dadang R. Subasri²

¹ School of Life Sciences and Technology, Institut Teknologi Bandung, 10, Jalan Ganesa, Bandung 40132, Indonesia

² Museum Zoologicum Bogoriense, Research Centre for Biology, the Indonesian Institute of Sciences, Cibinong, Bogor 16911, Indonesia

Abstract We describe a new cat snake species of the genus *Boiga* from the Nusa Tenggara Islands, Indonesia. The new species is superficially similar to *Boiga cynodon*, as it was identified previously. It differs from the latter species by the following combination of characteristics: only reaching half of the size of *B. cynodon* (up to 1250 mm SVL), higher number of dorsal scales; lower ventral and subcaudal counts and having only a very fine postorbital stripe.

Keywords Lesser Sunda Islands, *Boiga*, description, taxonomy, biogeography

1. Introduction

Approximately 400 species of snakes occur in Indonesia (Iskandar and Colijn, 2001). During the past decades, this number has remained relatively constant as little work has been done and very few herpetologists are working in Indonesia. The situation has changed over the last two decades as recently several new forms have been described based on new materials, mainly from central parts of Indonesia (in den Bosch and Ineich, 1994; Auliya *et al.*, 1996; Rasmussen *et al.*, 2001; Orlov and Ryabov, 2002; Orlov *et al.*, 2003; David and Das, 2003; Murphy *et al.*, 2005; Howards and Gillespie, 2007; Koch *et al.*, 2009). In addition, new species have also been described, mainly based on old museum collections and from pet trade (Vogel *et al.*, 2004; Vogel and Pauwels, 2004; David *et al.*, 2006, 2009; Kuch *et al.*, 2007; van Rooijen and Vogel, 2008a, 2008b; Vogel and van Rooijen, 2007, 2008).

The genus *Boiga* is widely distributed in Southeast Asia. Approximately 32–35 species are now considered

valid, and many of them have a very wide distribution (Iskandar and Colijn, 2002; Vogel, 2009). The genus comprises mostly large sized snakes that feed on birds and small mammals. Their extensive distribution is one of the reasons that a species such as *B. dendrophila* (Boie, 1827) has numerous but distinctive subspecies, a rare case for Southeast Asian herpetofauna. On the other hand a number of species is also known to be variable and several cryptic species have been described subsequently (Nootpand, 1971; Kroon, 1973; Orlov and Ryabov, 2002; Pauwels *et al.*, 2005; Vogel, 2009). One species was introduced in the past to many islands in the Pacific and even became a pest in Guam, being responsible for local fauna extinction and electricity shortages (Rodda *et al.*, 1997, 1999; Glade, 2002).

While working in Borneo, we collected a snake which is morphologically similar to *Boiga cynodon* (Boie, 1827) and looks rather unusual by being black. For this reason, an attempt to study the group further and examine specimens from much of its range is in operation.

2. Materials and Methods

Specimens used in this study are based on available materials, preserved at the Institut Teknologi Bandung (ITB) museum collection for the time being, resulting from various expeditions throughout the last 20 years. In addi-

*Corresponding author: Prof. Dr. Djoko T. Iskandar, Head of the Division of Ecology and Biosystematics, School of Life Sciences and Technology, Institut Teknologi Bandung West Java, Indonesia, with his research mainly focusing on biodiversity, evolution and biosystematics, biogeography, conservation, small vertebrates of Southeast Asia and Australasia.

E-mail: iskandar@sith.itb.ac.id

Received: 4 June 2010 Accepted: 12 August 2010

tion, we also examined *Boiga* specimens at the Museum Zoologicum Bogoriense (MZB) to obtain a good idea of the intraspecific variation within the genus. BAL, D, JAM, JS, KR, MK, DTI, GAG, HKV, refer to field numbers. Most of the comparative specimens will be deposited in MZB collections after thorough examination.

All characters were measured in mm for length. Description of the species follows the format of Orlov and Ryabov, 2002 or Orlov *et al.*, 2003. Measurements, except body and tail lengths, were taken with a slide-caliper to the nearest 0.1 mm. The number of ventral scales was counted according to Dowling (1951). The numbers of dorsal scale rows are given at one head length behind the head, at midbody, and at one head length anterior to the vent. The terminal scute is not included in the number of subcaudals. Values for symmetric head characters are given in left/right order. Abbreviations of measures and other meristic characters used in the text are: SVL: snout-vent length; TL: tail length; HL1: head length from base of lower jaw to snout tip; HL2: head length from base of first vertebrae to tip of snout; HD: head depth; HW: head width. ED: eye diameter; SL: snout length; BH: body height, measured at middle part of body; BW: body width measured at the same position of BH; EN: eye-narial distance; IOA, IOP: interorbital distance, measured at anterior and posterior borders of the eyes. Meristic characters: ABC, MBC, PBC refer to number of dorsal scale rows at anterior, midbody and posterior near the vent respectively; V: ventrals; SC: subcaudals; AT, PT: anterior and posterior temporals; ALo, PLo: anterior and posterior loreal; InL: infralabials; SuL: supralabials; PoO: postoculars; PrO: preoculars; SuO: supraoculars. Morphometric and meristic characters were standardized against standard length and analyzed in multivariate analyses. The results of morphological and meristic measurements were statistically analyzed by Principal Component Analysis (PCA) using SPSS 16.0 software. Statistical analysis was also performed with Kruskal Wallis and followed with Mann-Whitney U Test at $p < 0.01$ level of significance for characters that show little overlapping. The results are shown in the comparative section between brackets. As we use statistical analysis based on available materials, the known range of every character from the literature for comparisons and discussions are not used to ensure that the comparisons are not biased by hidden forms or due to geographical variations.

3. Taxonomic section

Boiga hoeseli new species (Figures 1, 2)



Figure 1 Dorsal view of the holotype of *Boiga hoeseli* new species (MZB Oph. 1242) from Larantuka, Flores



Figure 2 Lateral view of the holotype of *Boiga hoeseli* new species (MZB Oph. 1242)(A) and a paratype (MZB Oph. 2492)(B) to show the extent of the postocular stripe; Dorsal side of paratypes of *Boiga hoeseli* new species to show markings on the neck and dorsum of the head (MZB Oph. 2491, 2492; C, D).

Holotype MZB Oph. 1242, an adult female from Larantuka, Flores by Fr. J. M. Vianney coll., 3-ix-1958. Paratypes six specimens as follows: MZB Oph. 1244, an adult female from Boawae, Flores by Fr J. M. Vianney coll., 9-x-1958. MZB Oph. 2490, an adult female from Ngalu Sunda, Sumbawa by D. Kitchener & R. How coll., date not recorded. MZB Oph. 2491, an adult male, MZB 2492, adult female from Sidabui, Alor Island by D. Kitchener & R. How coll., date not recorded. MZB Oph. 1801, an adult female from Lombok Island by D. Hardjono, 14-iii-1978. MZB Oph. 1949, an adult female from Komodo Island by Condro, Forestry guard coll., v-1984.

The description is based on seven specimens and has previously been reported from Sumba and Rinca Island under the identity of *Boiga cynodon* (How and Kitchener, 1997). The record from Lombok is new, as no *Boiga* species have ever been recorded from the island.

Diagnosis A medium to large species (SVL up to 1250 mm, tail up to 408 mm); laterally compressed body with strongly enlarged vertebral scales, dorsal scales in 27(25)–27(25)–17(15) rows, ventrals 263.9 ± 6.77 (range 256–272 $n=7$), subcaudals in pairs, 128.8 ± 8.66 scales (range 113–134; $n=6$); anal plate entire; 9+9(10) supralabials, fourth, fifth, and sixth entering orbit; 14–14 (13–15) infralabials; rostral large, slightly visible from above; loreal longer than deep; one large preocular, reaching upper surface of head; two relatively small postoculars; large genials, anterior genial relatively smaller than posterior. Body scales smooth without keels or pits. Ventrals immaculate yellow, upper part of head almost without pattern except for a few spots in between head scales, a thin streak from behind the eye extending to the corner of the jaws is usually present (Figure 2 C, D).

Etymology Named after J. K. P. van Hoesel who wrote the first guide book about snakes of Java, *Ophidia Javanica* in 1959. He was also well known as a snake specialist and collected many specimens for MZB and SMF (Frankfurt am Mainz, Germany) and all his donations were usually registered under the name Frater Jean Marie Vianney so that very few people recognize that J. K. P. van Hoesel was the same person as the Catholic priest or Dutch missionary at Larantuka, Flores, Nusa Tenggara after the World War II. He died from a snake bite around 1960. J. K. P. van Hoesel provided first hand information about Nusa Tenggara's *Daboia russelli limitis* (Mertens, 1927) (currently called *Daboia siamensis*), after it was discovered by the Sunda Expedition Rensch in 1926 (Mertens, 1927). Apparently, this species is quite threatening the local people as he published four papers about that species (van Hoesel, 1954, 1958, 1959; Vianney, 1957).

Description of the holotype A medium sized snake, female, body much flattened dorsoventrally (laterally compressed), head distinct from neck, distinctly wider than deep. Snout projecting beyond lower jaw, snout longer than diameter of eye; rostral more broad than deep; slightly visible from above; internasal shorter than prefrontal; prefrontal longer than its distance from the tip of snout; frontal as long or longer than its distance from the tip of snout; frontal shorter than parietal; loreals 2/2, anterior approximately two-thirds longer than posterior ones, excluded from eye by a preocular, which extends to the upper surface of the head, not touching frontal; in contact with 3rd supralabial, not touching internasals; two postoculars, slightly visible from above; supralabials

9/9 with third to fifth in contact with eye; infralabials 14/14, first pair in contact along midline, first five in contact with anterior chin shields; anterior chin shield larger than posterior one, in contact at midline; posterior chin shields slightly shorter and narrower than anterior one, in broad contact; two anterior, three posterior temporals. Anterior palatine teeth enlarged, anterior teeth of lower jaws equally enlarged. Dimensions: snout–vent length 1182 mm, tail length 336 mm (28% of SVL), head length (snout tip to posterior end of mandible) 36.3 mm, total length 1518 mm. Scalation: dorsal scales in 27–27–17 rows, ventrals 270, subcaudals 127, all divided; anal scute entire.

Body colouration and pattern of the new species

Dorsal surface of body and tail brownish yellow, with 30–35, not very distinct darker bands across the body and 20–26 others across the tail (counted along the vertebral scale row); body bands are 1–3 scales wide, and not widened laterally; anterior bands broader and more widely spaced than posterior bands; first two bands entire, the more posterior bands occasionally broken, concentrated in the median part of the band; ventral surface mostly cream coloured; the first six dark bands encroach onto the outer parts of the ventral scales only, the more posterior bands increasingly extending to the ventral side, and the last two cross the ventral side almost unattenuated; ventral side of the tail yellowish, except for the dark speckling at the level of the bands. Dorsal part of the head largely yellowish, except for slightly lighter sutures between the frontal and parietal scales; temporal region usually with a very fine black postorbital-temporal stripe, extending from eye, backwards to temporal region and extending to neck and body, width about 2 dorsal scales along paravertebral row, and heavily suffused with black pigment, separates dorsal part of the head, from the first dark body band; sides of head brown as body colouration, except for most of supralabial region; underside of head cream, except for black spots on mental and first three infralabials (Figure 2A, B).

Variations One of the paratypes (MZB Oph. 2490) from Sumbawa Island differs in having only 25 scale rows around the body (Table 1). It also differs from other paratypes in having a slightly smaller head, eyes, IOA, IOP, BH and BW. Another paratype (MZB Oph. 2492) from Alor Island also had 25 scale rows at the anterior part of the body. We put aside the possibility that they belong to a different species based on their geographic distribution. The black postorbital-temporal stripe is ab-

Table 1 Descriptive measurements and scale counts of the type series of *Boiga hoeseli* new species. See materials and methods for abbreviations.

| | MZB Oph. 1242 | MZB Oph. 1244 | MZB Oph. 1801 | MZB Oph. 1949 | MZB Oph. 2490 | MZB Oph. 2491 | MZB Oph. 2492 |
|------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | Holotype | Paratype | Paratype | Paratype | Paratype | Paratype | Paratype |
| Sex | Female | Female | Female | Female | Female | Male | Female |
| Loc. | Flores | Flores | Lombok | Komodo | Sumbawa | Alor | Alor |
| SVL | 1182 | 424 | 974 | 632 | 1001 | 1233 | 1249 |
| TL | 336 | 101 | 321 | 195 | 301 | 408 | 204+ |
| HL1 | 36.3 | 19.0 | 32.2 | 23.2 | 31.6 | 39.4 | 42.2 |
| HL2 | 25.0 | 14.9 | 23.8 | 17.5 | 22.2 | 26.7 | 27.6 |
| HD | 15.6 | 7.9 | 14.8 | 10.5 | 12.8 | 14.3 | 18.2 |
| ED | 6.9 | 4.4 | 6.7 | 5.3 | 6.3 | 6.9 | 7.4 |
| SL | 11 | 5.8 | 9.7 | 7.4 | 9.9 | 12.3 | 12.4 |
| EN | 5.6 | 3.0 | 5.4 | 4.3 | 5.6 | 6.8 | 6.4 |
| IOA | 12.6 | 7.0 | 11.6 | 9.3 | 11.2 | 14.4 | 14.6 |
| IOP | 17.5 | 10.6 | 16.0 | 13.1 | 15.5 | 18.7 | 20.9 |
| BH | 23.3 | 9.2 | 23 | 14.2 | 19.2 | 27.8 | 30.5 |
| BW | 14.2 | 8.8 | 13.0 | 11.6 | 15.4 | 18.4 | 20.1 |
| SuL | 9/9 | 10/9 | 9/9 | 9/9 | 9/9 | 9/9 | 9/9 |
| InL | 14/14 | 13/14 | 13/14 | 14/14 | 15/14 | 13/14 | 13/13 |
| PrO | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| PoO | 2/2 | 2/2 | 2/2 | 2/2 | 2/2 | 2/2 | 2/2 |
| SuO | 4/4 | 4/4 | 4/4 | 4/4 | 4/4 | 4/4 | 4/4 |
| ALo | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| PLo | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| AT | 2/2 | 2/2 | 2/2 | 2/2 | 2/2 | 2/2 | 2/2 |
| PT | 3/3 | 3/3 | 3/3 | 3/3 | 3/3 | 3/3 | 3/3 |
| ABC | 27 | 27 | 27 | 27 | 25 | 27 | 25 |
| MBC | 27 | 27 | 27 | 27 | 25 | 27 | 27 |
| PBC | 17 | 15 | 15 | 15 | 15 | 15 | 15 |
| V | 270 | 256 | 259 | 263 | 257 | 272 | 270 |
| SC | 127 | 134 | 128 | 134 | 113 | 137 | 53+ |

sent in the holotype (Figure 2B). The only male has a slightly higher subcaudal count (137) compared to the five other females (113–134). Whether this small difference reflects sexual dimorphism, present data are not enough to arrive on a firm conclusion.

Comparisons *Boiga hoeseli* is similar in body shape to *B. cynodon*, but smaller and only attains a total length to about 1650 mm, in contrast to *B. cynodon* that can grow over 2500 mm. The tail length is slightly longer with considerable overlapping (*B. hoeseli* 22%–25%, average 24%, *B. cynodon* 20%–24%, average 21%). *Boiga hoeseli* has a higher number of body scales compared to *B. cynodon* (27–27–15 vs. 23–23–15 [$p < 0.001$]), lower number of ventral scales (263.86 ± 6.77 vs. 279.70 ± 10.36 [$p < 0.02$]) and also lower number of subcaudal scales

(128.83 ± 8.66 vs. 151.18 ± 8.34 [$p < 0.001$]) as shown in Table 2. The colour pattern is similar although only faintly marked at the anterior part of dorsum but never as bold as in most *B. cynodon* specimens. The post-ocular-temporal stripe is very fine in the paratypes and absent in the holotype of *B. hoeseli*, but it is wide and always present in *B. cynodon*. From principal component analysis, *B. hoeseli* is clearly separated from *B. cynodon* (Figure 3).

Boiga hoeseli differs from *B. dendrophila*, *B. jaspidea* (Duméril, Bibron & Duméril, 1854) and *B. multomaculata* (Boie, 1827) in colouration as well as in numerous scalation characters. It differs from *B. drapiezii* (Boie, 1827) by having more scale rows (27–27–15 vs. 19–19–13), though numbers of ventrals and subcaudals are near completely overlapping (V: 256–272 vs.

Table 2 Comparison between the nine *Boiga* species of Indonesia. Upper case, average \pm SD; lower case, range.

| | <i>Boiga cynodon</i> n=11 | <i>Boiga dendrophila</i> n=15 | <i>Boiga drapiezii</i> n=9 | <i>Boiga hoesseli</i> n=7 | <i>Boiga irregularis</i> n=15 | <i>Boiga jaspidea</i> n=7 | <i>Boiga multimaculata</i> n=6 | <i>Boiga nigriceps</i> n=9 | <i>Boiga tanahjampeana</i> n=2 |
|----------|-------------------------------|----------------------------------|-------------------------------|------------------------------|----------------------------------|------------------------------|-----------------------------------|-------------------------------|-----------------------------------|
| SVL | ~2052 mm | ~1397 mm | ~1190 mm | ~1250 mm | ~1403 mm | ~916 mm | ~663 mm | ~1138 mm | ~1272 mm |
| TL | ~549 mm | ~372 mm | ~429 mm | ~408 mm | ~312 mm | ~313 mm | ~150 mm | ~416 mm | ~307 mm |
| ABC | 23.36 \pm 1.96 19–25 | 21.00 \pm 0.00 21 | 19.00 \pm 0.00 19 | 26.43 \pm 0.98 25–27 | 21.40 \pm 1.12 19–23 | 21.57 \pm 0.98 21–23 | 19.00 \pm 0.00 19 | 21.00 \pm 1.00 19–23 | 25, 23 |
| MBC | 23 \pm 1.50 19–25 | 20.71 \pm 0.73 19–21 | 19.00 \pm 0.00 19 | 26.71 \pm 0.76 25–27 | 21.30 \pm 1.03 19–23 | 21.00 \pm 0.00 21 | 19.00 \pm 0.00 19 | 21.22 \pm 0.67 21–23 | 23 |
| PBC | 15 \pm 0.92 13–15 | 14.50 \pm 0.94 12–15 | 14.00 \pm 2.35 13–15 | 15.29 \pm 0.76 15–17 | 15.00 \pm 1.07 13–17 | 15.00 \pm 0.00 15 | 15.00 \pm 0.00 15 | 14.89 \pm 0.78 13–16 | 17 |
| V | 279.70 \pm 10.36 254–285 | 226.00 \pm 5.71 219–235 | 264.44 \pm 7.18 254–279 | 263.86 \pm 6.77 256–272 | 261.13 \pm 5.77 251–268 | 253.71 \pm 7.36 245–267 | 215.33 \pm 4.72 211–217 | 254.89 \pm 8.98 238–270 | 218–226 |
| SC | 151.18 \pm 8.34 133–165 | 92.50 \pm 19.76 71–110 | 143.67 \pm 15.48 112–161 | 128.83 \pm 8.66 113–134 | 109.07 \pm 14.08 98–121 | 144.49 \pm 5.65 134–149 | 88.80 \pm 4.50 85–95 | 130.33 \pm 13.96 106–143 | 100–102 |
| SuL | 9.00 \pm 0.62 8–11 | 8.00 \pm 0.00 8 | 8.11 \pm 0.24 8–9 | 9.07 \pm 0.27 9–10 | 9.00 \pm 0.26 8–10 | 8.00 \pm 0.00 8 | 8.00 \pm 0.00 8 | 8.11 \pm 0.32 8–9 | 8/8 |
| InL | 13.64 \pm 1.09 11–15 | 11.00 \pm 0.33 10–12 | 11.11 \pm 0.88 10–13 | 13.71 \pm 0.61 13–15 | 13.00 \pm 0.85 12–15 | 11.79 \pm 0.80 11–13 | 10.50 \pm 0.67 9–11 | 12.00 \pm 0.79 11–13 | 11/11 |
| TL/Total | 0.21 \pm 0.01 0.20–0.24 | 0.21 \pm 0.02 0.17–0.23 | 0.25 \pm 0.02 0.21–0.28 | 0.24 \pm 0.01 0.22–0.25 | 0.25 \pm 0.04 0.21–0.31 | 0.28 \pm 0.02 0.25–0.31 | 0.20 \pm 0.01 0.18–0.22 | 0.24 \pm 0.02 0.20–0.26 | 0.19–0.22 |
| HD/HW | 0.81 \pm 0.19 0.59–1.16 | 0.72 \pm 0.08 0.53–0.81 | 0.64 \pm 0.04 0.57–0.68 | 0.71 \pm 0.08 0.59–0.83 | 0.67 \pm 0.09 0.59–0.88 | 0.70 \pm 0.05 0.62–0.68 | 0.71 \pm 0.03 0.66–0.74 | 0.85 \pm 0.72 0.51–0.78 | 0.69–0.74 |
| ED/SL | 0.63 \pm 0.10 0.53–0.87 | 0.67 \pm 0.10 0.53–0.92 | 0.78 \pm 0.12 0.65–1.08 | 0.66 \pm 0.07 0.56–0.76 | 0.65 \pm 0.08 0.54–0.77 | 0.96 \pm 0.08 0.87–1.10 | 0.72 \pm 0.08 0.66–0.87 | 0.71 \pm 0.08 0.62–0.85 | 0.60–0.74 |
| EN/SL | 0.52 \pm 0.06 0.42–0.60 | 0.47 \pm 0.05 0.37–0.54 | 0.47 \pm 0.22 0.42–0.58 | 0.54 \pm 0.03 0.52–0.58 | 0.53 \pm 0.04 0.49–0.60 | 0.44 \pm 0.05 0.40–0.48 | 0.46 \pm 0.07 0.39–0.58 | 0.49 \pm 0.06 0.40–0.57 | 0.43–0.47 |
| SL/HL1 | 0.30 \pm 0.02 0.27–0.32 | 0.27 \pm 0.01 0.24–0.29 | 0.31 \pm 0.04 0.26–0.41 | 0.31 \pm 0.01 0.30–0.32 | 0.29 \pm 0.01 0.27–0.31 | 0.29 \pm 0.01 0.27–0.32 | 0.27 \pm 0.01 0.26–0.29 | 0.28 \pm 0.01 0.26–0.30 | 0.28–0.30 |
| IOA/IOP | 0.70 \pm 0.07 0.54–0.78 | 0.70 \pm 0.04 0.64–0.75 | 0.65 \pm 0.03 0.62–0.70 | 0.72 \pm 0.03 0.66–0.77 | 0.67 \pm 0.07 0.63–0.91 | 0.66 \pm 0.04 0.60–0.71 | 0.65 \pm 0.02 0.64–0.67 | 0.69 \pm 0.05 0.64–0.79 | 0.76–0.79 |
| AT/PT | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 |
| PrO/PoP | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 |
| SuO | 4/4 | 5/5 | 5/5 | 4/4 | 5/5 | 5/5 | 5/5 | 6/6 | 5/5 |

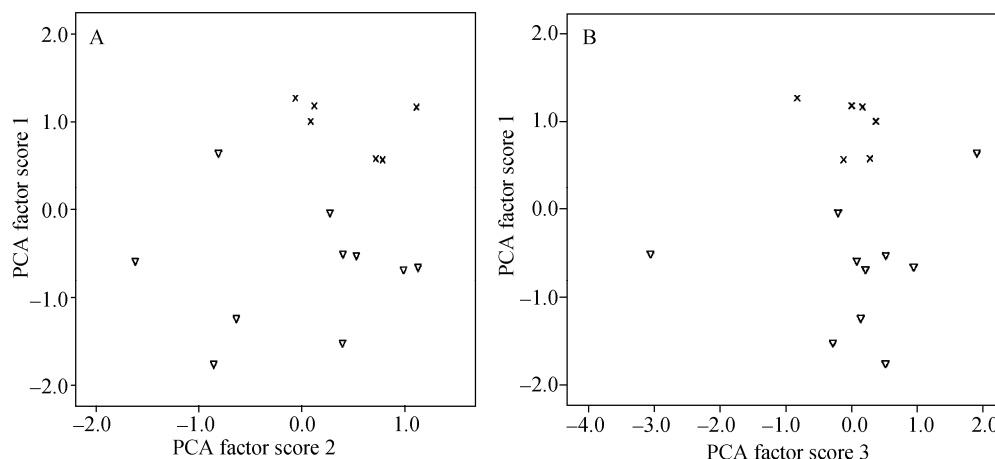


Figure 3 Result of principal component analysis based on specimens of *Boiga cynodon* (triangle) and of *Boiga hoeseli* new species (cross)

254–279 [n.s]; SC: 113–134 vs. 112–161 [$p < 0.025$]). Supralabials and infralabials are higher in *B. hoeseli* compared to *B. drapiezii* (SuL: 9/9 vs. 8/8 [$p < 0.001$]; InL: 14/14 vs. 11/11 [$p < 0.001$]) and the two have completely different colouration. *Boiga bengkulensis* Orlov, Kudryavtzev, Ryabov & Shumakov, 2003, not available for examination, is very similar to *B. drapiezii* in most characteristics except by the presence of a midventral stripe in *B. bengkulensis*; hence our comparison between *B. hoeseli* and *B. drapiezii* might apply to *B. bengkulensis* as well. *Boiga irregularis* (Bechstein, 1802) can be equally yellowish brown as is *B. hoeseli* and are of about the same size. *Boiga hoeseli* has a higher number of scale rows around body (27–27–15 vs. 21–21–15). *Boiga hoeseli* is larger and much more robust compared to *B. jaspidea* and has higher number of body scales (27–27–15 vs. 21–21–15). The number of ventrals and subcaudals of *B. hoeseli* and *B. jaspidea* are also nearly over-lapping (V: 256–272 vs. 245–267 [$p < 0.02$]); SC: 113–134 vs. 134–149 [$p < 0.006$]), but *B. hoeseli* has higher number of supra- and infralabials (9/9 and 14/14 vs. 8/8 and 12/12 respectively [$p < 0.001$ for both]). The new species can attain about the same size as *B. nigriceps* (Günther, 1863), has about the same number of ventrals and subcaudals (V: 256–272 vs. 238–270 [$p < 0.03$]; SC: 113–134 vs. 106–143 [n.s.]), but has more scale rows around the body (27–27–25 vs. 21–21–15), higher numbers of supra- and infralabials (9/9 vs. 8/8 and 14/14 vs. 12/12 [$p < 0.002$ for both]). *Boiga hoeseli* differs from *B. tanahjampeana* (Orlov and Ryabov, 2002), in having higher number of scales around body (27–27–25 vs. 25–23–17), higher ventrals and subcaudals (V: 256–272 vs. 218–226 [$p < 0.04$]; SC: 113–134 vs. 100–102) and a completely different colouration. *Boiga hoeseli* is ex-

tremely similar to *B. forsteni* (Duméril, Bibron and Duméril, 1854) in many aspects (Wall, 1921). Dorsal scales count is similar to *B. forsteni* which has 25–27 dorsal scales at mid body. Ventral scale count of *B. hoeseli* (256–272) completely overlaps that of *B. forsteni* (254–270). Subcaudals also show a nearly complete overlapping, (*B. hoeseli* 113–134; *B. forsteni* 103–131). The differences between both are in size, where the *B. hoeseli* maximum only 1650 mm in contrast to *B. forsteni* which could attain 2312 mm in total length. *Boiga hoeseli* also differs from *B. forsteni* in having higher infralabials count. *Boiga hoeseli* has 13–15 infralabials, *B. forsteni* was described only having 7–8 infralabials (Wall, 1921). For other subtle differences between Indonesian species in measurements, see Table 2.

4. Discussion

Curiously, this new species is superficially very similar to *B. forsteni* of Sri Lanka, a convergence that is difficult to comprehend. There is a similar situation, between *Coelognathus subradiatus* (Schlegel, 1837) of the Nusa Tenggara Islands and *C. enganesis* (Vinciguerra, 1892) from Enggano Island west off Sumatra, although the status of the latter was never solved (de Rooij, 1917; Brongersma, 1934; Kopstein, 1937; Schulz, 1988, 1995; Wallach, 1997; Utiger *et al.*, 2005). Most herpetofauna of Indonesia exhibit more or less the same distributional patterns for each geographical subregion. Only few species deviate from the common distributional pattern, such as *Broghammerus molurus* (Linn, 1858), *Daboia siamensis* (Smith, 1917) and *Calloselasma rhodostoma* (Kuhl, 1824) because of their absence in Sumatra and Borneo and presence in Java and mainland Southeast Asia (de

Haas, 1950; Iskandar and Colijn, 2001). It is interesting that the unusual distribution of *B. cynodon* outside Sundaland, in the Nusa Tenggara Islands, east of Wallace line and in the Wallacean subregion (Mertens, 1928a, 1930, 1934; 1950; How and Kitchener, 1997; Iskandar and Colijn, 2001; Inger and Voris, 2001) remained unnoticed. *Boiga cynodon* is absent on Sulawesi and Maluku. It is known previously from the Lesser Sunda islands up to Alor Island in the east as *B. cynodon* before we recognized it as *B. hoeseli*. Interestingly *B. cynodon*, despite its absence in Sulawesi, it is well known from larger parts of the Philippines, also outside the Sundaland; these populations deserve further examination. The finding of *B. hoeseli* that has more or less the same colour pattern as *B. cynodon*, is only recognized after careful measurements, confirmed the suggestion of Orlov and Ryabov (2002) that Asian species of the genus *Boiga* morphologically related to *B. cynodon* are in need of revision. Upon the discovery of this new species, the distribution of *B. cynodon* should be removed from the snake species lists of the Nusa Tenggara Islands. The distribution of *B. hoeseli* is similar to *Coelognathus subradiatus*, *Cylindrophis opistorhodus* (Boulenger, 1897), *Limnionectes kadorsani* (Iskandar *et al.*, 1996), and *L. dammermani* (Mertens, 1929), which are restricted to the Nusa Tenggara Islands (Mertens, 1929; How and Kitchener, 1997; Iskandar *et al.*, 1996; Iskandar and Colijn, 2000, 2001).

Key to species of the genus *Boiga* in Indonesia

- 1 Body black with narrow yellow or whitish bands, in Sumatran population the light bands only confined to lateral side of body *Boiga dendrophila*
Body colouration not black, but maybe blackish in some specimens 2
- 2 Body colouration yellowish to reddish brown or grayish, uniform or with more or less dark bands, variable in width 3
Body with irregular pattern or blotched 7
- 3 Body uniform or with very fine bands 4
Body with more or less wide bands 6
- 4 Body uniform, each scales with darker borders
..... *Boiga tanahjampeana*
Body with very fine bands, sometimes uniform, but scales without darker borders 5
- 5 Body uniformly yellowish to orange or brownish red, sometimes bands absent, head greenish or blackish in adults
..... *Boiga nigriceps*
Body usually grayish to yellowish, usually with fine bands
..... *Boiga irregularis*
- 6 Body with more or less wide blackish bands interspaced with narrow bands, body with 23 (rarely 19–25) scales around midbody, ventrals 248–290 scales, subcaudals 133–165 scales *Boiga cynodon*
Body with indistinct bands and not interspaced with narrow bands, scales 25–27 rows around midbody, ventrals 256–272 scales, subcaudals 113–134 scales *Boiga hoeseli*
- 7 Body mottled or blotched 8
Body greenish or brownish with irregular blotches, a reddish spot usually present at the flanks near ventral scutes
..... *Boiga drapiezii* and *B. bengkulensis**
- 8 Body with reddish brown bold rounded spots arranged in four rows, head with four large reddish brown rounded spots
..... *Boiga multomaculata*
Body marbled or blotched, or with bands on the sides, vertebrals and paravertebrals with dark spots alternating with lateral bands, head with blackish spots with reddish borders. White spots along flanks and at the base on black bands and ventral scales *Boiga jaspidea*

* As the original description of *Boiga bengkulensis* does not show any characters to distinguish it from *B. drapiezii*, we placed both species in a single entry.

Acknowledgments We are very grateful to Dr. A. Arief, Director of MZB, H. Kurniati, I. Sidik, Mumpuni, A. Riyanto and Boeadi (MZB) who were helpful during the first author work with the MZB collection. We thank R. F. Inger (FMNH) who read a previous version of this work and gave us valuable advice. Our sincere appreciations are addressed to the two reviewers (R.F. Inger, R. Diaz and G. Vogel) which cleared many dubious expressions and add considerable quality to this manuscript.

References

- Auliya M., Mausfeld P., Schmitz A., Böhme W. 2002. Review of the reticulated python (*Python reticulatus* Schneider, 1801) with the description of new subspecies from Indonesia. *Naturwissenschaften*, 89: 201–213
- Brongersma L. D. 1934. Contributions to Indo-Australian herpetology. *Zool Meded*, 17: 161–251; Pls. 1–2
- David P., Das I. 2003. A new species of the snake genus *Amphiesma* (Serpentes: Colubridae: Natricinae) from Western Sumatra, Indonesia. *Raffles Bull Zool*, 51: 413–419
- David P., Petri M., Vogel G., Doria G. 2009. A new species of pitviper of the genus *Trimeresurus* (*Popeia*) from northern Sumatra (Reptilia, Squamata, Viperidae). *Ann Mus Civico di Storia Nat "G. Doria"*, Genova C: 323–346
- David P., Vogel G., Vijayakumar S. P. Vidal N. 2006. A revision of the *Trimeresurus puniceus*-Complex (Serpentes: Viperidae: Crotalinae) based on morphological and molecular data. *Zootaxa*, 1293: 1–78
- de Haas C. P. J. 1950. Checklist of the snakes of the Indo-Australian Archipelago (Reptiles, Ophidia). *Treubia*, 20: 511–625
- de Rooij N. 1917. The Reptiles of the Indo-Australian Archipelago. II. *Ophidia*. Leiden: E. J. Brill, 334 pp

- Dowling H.** 1951. A proposed standard system of counting ventrals in snakes. *Br J Herpetol*, 1: 97–99
- Glade U.** 2002. Dezimierung der Kleintierfauna auf der Pazifikinsel Guam durch die invasive Braune Nachtbaumnatter (*Boiga irregularis*). *Sauria*, 10: 60–65
- Howard S. D., Gillespie G. R.** 2007. Two New *Calamaria* (Serpentes) Species from Sulawesi, Indonesia. *J Herpetol*, 41: 237–242
- How R. A., Schmitt L. H., Maharadatunkamsi.** 1996. Geographical variation in the genus *Dendrelaphis* (Serpentes: Colubridae) within the islands of south-eastern Indonesia. *J Zool*, 238: 351–363
- How R. A., Kitchener D. J.** 1997. Biogeography of Indonesian snakes. *J Biogeogr*, 24: 725–735
- In den Bosch H. A. J., Ineich I.** 1994. The Typhlopidae of Sulawesi (Indonesia): a review with description of a new genus and a new species (serpents, Typhlopidae). *J Herpetol*, 28: 206–217
- Inger R. F., Voris H. K.** 2001. The biogeographical relations of the frogs and snakes of Sundaland. *J Biogeogr*, 28: 863–891
- Iskandar D. T., Boeadi, Sancoyo M.** 1996. *Limnonektes kadarsani* (Amphibia, Anura, Ranidae), a new frog from the Nusa Tenggara Islands. *Raffles Bull Zool*, 44: 1–9
- Iskandar D. T., Colijn E.** 2000. Checklist of Southeast Asian and New Guinean herpetofauna I. Amphibians. *Treubia*, 31: 1–133
- Iskandar D. T., Colijn E.** 2001. Checklist of Southeast Asian Reptiles I. Snakes, Bogor, Biodiversity Conservation Project, ITB & Gibbon Foundation. 195 pp
- Koch A., Arida E., McGuire J. A., Iskandar D. T., Böhme W.** 2009. A new species of *Calamaria* (Squamata: Colubridae) similar to *C. ceramensis* de Rooij, 1913, from the Banggai Islands, east of Sulawesi, Indonesia. *Zootaxa*, 2196: 19–30
- Kopstein F.** 1937. Schlangen von Enggano. *Treubia*, 16: 239–244
- Kroon C.** 1973. A new colubrid snake (*Boiga*) from Southeastern Asia. *Copeia*, 1973: 580–586
- Kuch U., Gumprecht A., Melaun C.** 2007. A new species of Temple Pitviper (*Tropidolaemus* Wagler, 1830) from Sulawesi, Indonesia (Squamata: Viperidae: Crotalinae). *Zootaxa*, 1446: 1–20
- Mertens R.** 1927. Herpetologische Mitteilungen XVIII. Zur verbreitung der *Vipera russelii* Shaw. *Senckenbergiana*, 9: 182–184
- Mertens R.** 1928. Über die zoogeographische Bedeutung der Balistraße auf Grund der Verbreitung von Amphibien und Reptilien. *Zool Anz*, 78: 77–82
- Mertens R.** 1929. Herpetologische Mitteilungen XXV. Zur Kenntnis der *Rana microdisca* Boettger und ihrer Rassen. *Zool Anz*, 86: 66–68
- Mertens R.** 1930. Die Amphibien und Reptilien der Inseln Bali, Lombok, Sumbawa und Flores. *Abhandl. Senckenberg. Naturf Gessell*, 42: 115–344
- Mertens R.** 1934. Die Schlangengattung *Dendrelaphis* Boulenger in systematischer und zoogeographischer Beziehung. I. *Arch Naturgessell*, 3: 187–204
- Mertens R.** 1950. Die tiergeographische Bedeutung der Bali-Strasse: eine Richtigstellung. *Senckenbergiana*, 1: 9–10
- Murphy J. C., Voris H. K., Auliya M.** 2005. A new species of *Enhydryis* (Serpentes: Colubridae: Homalopsinae) from the Kapuas river system, West Kalimantan, Indonesia. *Raffles Bull Zool*, 53: 271–275
- Nootpand W.** 1971. Poisonous Snakes of Thailand. Bangkok: Thai Zoological Centre
- Orlov N. L., Ryabov S. A.** 2002. A new species of the genus *Boiga* (Serpentes, Colubridae, Colubrinae) from Tanah Jamea Island and description of ‘black form’ of *Boiga cynodon* complex from Sumatra (Indonesia). *Russ J Herpetol*, 9: 33–56
- Orlov N. L., Kudryavtzev S. V., Ryabov S. A., Shumakov O. V.** 2003. A new species of genus *Boiga* (Serpentes: Colubridae: Colubrinae) and color atlas of boigas from Bengkulu Province (Sumatra, Indonesia). *Russ J Herpetol*, 10: 33–52
- Pauwels O. S. G., David P., Chanhom L., Vogel G., Chan-ard T., Orlov N. L.** 2005. On the status of *Boiga ocellata* Kroon, 1973, with the designation of a neotype for *Boiga siamensis* Nootpand, 1971 (Serpentes, Colubridae). *Russ J Herpetol*, 12: 102–106
- Rasmussen A. R., Auliya M., Bohme W.** 2001. A new species of the sea snake genus *Hydrophis* (Serpentes, Elapidae) from a river in West Kalimantan (Indonesia, Borneo). *Herpetologica*, 57: 23–32
- Rodda G. H., Fritts T. H., Chiszar D.** 1997. The disappearance of Guam's wildlife. *BioScience*, 47(9): 565–574
- Rodda G. H., Fritts T. H., McCoid M. J., Campbell III E. W.** 1999. An overview of the biology of the brown treesnake (*Boiga irregularis*), a costly introduced pest on Pacific islands. 44–80. In Rodda G. H., Sawai Y., Chiszar D., Tanaka H. (eds.). *Problem Snake Management: the Habu and Brown Treesnake*. Ithaca: Cornell Univ Press
- Schulz K. D.** 1988. Die hinter-asiatischen Kletternattern der Gattung *Elaphe*. Teil 14. *Elaphe subradiata* (Schlegel, 1837) und *Elaphe erythrura* (Duméril & Bibron, 1854). *Sauria*, 10: 17–20
- Schulz K. D.** 1996. A Monograph of the Colubrid Snakes of the Genus *Elaphe* Fitzinger. Czechoslovakia: Havlicuv Brod, Koeltz, Scientific Books
- Utiger U., Schätti B., Helfenberger N.** 2005. The Oriental Colubrine genus *Coelognathus* Fitzinger, 1843 and classification of Old and New World Racers and Ratsnakes (Reptilia, Squamata, Colubridae, Colubrinae). *Russ J Herpetol*, 12: 39–60
- van Hoesel J. K. P.** 1954. *Vipera russelii* - its zoogeographical range and local distribution in Indonesia. *Trop Nat*, 33: 133–139
- van Hoesel J. K. P.** 1958. Notities over *Vipera russelii* en enkele andere slangen van Flores. *Lacerta*, 16: 32–36
- van Hoesel J. K. P.** 1959. *Ophidia Javanica*. Museum Zoologicum Bogoriense, Bogor, Archipel Publ, 188 pp
- van Rooijen J., Vogel G.** 2008a. A new species of *Dendrelaphis*

- from Java, Indonesia. *Raffles Bull Zool*, 56: 189–197
- van Rooijen J., Vogel G.** 2008b. Contributions to a review of the *Dendrelaphis pictus* complex (Serpentes: Colubridae)-1. Description of a sympatric species. *Amph Rept*, 29: 101–115
- Vianney J. M.** 1957. *Vipera russellii*, sematjam ular berbisa jang dahsjat dipulau Flores. *Bentara*, 10: 31
- Vogel G.** 2009. Checklist of the genus *Boiga* (Serpentes: Colubridae). Retrieved from <http://gemot-vogel.de>
- Vogel G., van Rooijen J.** 2007. A new species of *Dendrelaphis* (Serpentes: Colubridae) from Southeast Asia. *Zootaxa*, 1394: 25–45
- Vogel G., van Rooijen J.** 2008. Contributions to a review of the *Dendrelaphis pictus* (Gmelin, 1789) complex-2. The eastern forms (Serpentes: Colubridae). *Herpetozoa*, 21: 3–29
- Vogel G., David P., Pauwels O. S. G.** 2004. A review of morphological variation in *Trimeresurus popeiorum* (Serpentes: Viperidae: Crotalinae), with the description of two new species. *Zootaxa*, 727: 1–63
- Wall F.** 1921. *Ophidia Taprobanica or the Snakes of Ceylon*. 1st ed. Colombo, HR Cottle, Government Printer, 581 pp
- Wallach V.** 1997. A monograph of the colubrid snakes of the genus *Elaphe* Fitzinger, by Klaus-Dieter Schulz, 1996 [book review]. *Herpetol Rev*, 28: 109–111

Appendix 1 Material examined:

Boiga cynodon: MZB Oph. 0678; 0831 from Java; MZB Oph. 0816; 3763; 2151; 2207 from Sumatra; MZB Oph. 2877; 2431; 1815; DTI 1022 from West Borneo. *Boiga dendrophila*: HKV 67344 from East Borneo; MZB Oph. 2990; 2860; 3620; 3052; 2051; 2947; 3482; 802; JAM 3482; 5816; 3528; 3481; 6020; 3475 from Sulawesi. *Boiga drapiezii*: MZB Oph. 2663; 3778 (2 ex.) from Java; MZB Oph. 1827; 2403; 3714; JAM 10634 from Sumatra, MZB Oph. 0781 from unknown locality; DTI 768 from Borneo. *Boiga irregularis*: MZB Oph. 3387; 3651; 3652; JAM 7879 from Sulawesi; MZB Oph. 2363 (2 ex) from Maluku; MZB Oph. 2747 (2ex.); GAG 0056; 0062; 0111 from Gag, Raja Ampat Islands; MZB Oph. 2612; 2707; DTI 1920 from Papua. *Boiga jaspidea* MZB Oph. 2334 MK 370; 385 from Sumatra; MZB Oph. 2878; JS 014; Bal 0125; D37 from Borneo; *Boiga multomaculata*: MZB Oph. 1294; 1686; 2182; 3549; 2006; 2092 from Java. *Boiga nigriceps*: MZB Oph. 3726 from Sumatra; MZB Oph. 2651; 3029; 2778; DTI 0264; 0072; 1102; KR 0391 from Borneo. *Boiga tanahjampeana*: MZB Oph. 3033; 3219 from Tanah Jampea Island.